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(to be used for all correspondence after initial filing)

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Filing Date	December 13, 2001
First Named Inventor	James Florence
Art Unit	2872
Examiner Name	Arnel C. Lavarias
Total Number of Pages in This Submission	
Attorney Docket Number	SLA0354

ENCLOSURES ***(check all that apply)***

- ☒ Fee Transmittal Form
- ☐ Fee Attached
- ☐ Amendment / Reply
- ☐ After Final
- ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
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- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
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- ☒ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☐ Other Enclosure(s) *(please identify below)*:

Remarks

3

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm	Sharp Laboratories of America, Inc.		
Signature			
Printed Name	David C. Ripma, Patent Counsel		
Date	October 12, 2005	Reg. No.	27,672

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:		
Inventor:	James M. Florence	Attorney Docket No. SLA0354
Serial No.:	10/021,988	Customer No. 27,518
Filed:	December 13, 2001	Group Art Unit 2872
Title:	POLARIZED LIGHT BEAM SPLITTER ASSEMBLY INCLUDING EMBEDDED WIRE GRID POLARIZER	Examiner: Lavarias, A.
		Confirmation No.: 7651

Board of Appeals and Interferences
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF TRANSMITTAL LETTER

Enclosed is a copy of an Appeal Brief for the above-mentioned application, responsive to a Final Office Action mailed August 4, 2005. A Notice of Appeal for the above-mentioned application accompanies this paper.

10/17/2005 EFLORES 00000079 500803 10021988
01 FC:1402 500.00 DA

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X____ The Commissioner is hereby authorized to charge underpayment of any fees, or credit any overpayment associated with this communication to Deposit Account No. 500803.

10/12/05

Date

Respectfully submitted,

David C. Ripma
Registration No. 27,672

Customer No. 27518
David Ripma, Patent Counsel
Sharp Laboratories of America, Inc.
5750 NW Pacific Rim Blvd.
Camas, WA 98607
Telephone: (360) 834-8754
Facsimile: (360) 817-8505

OIPE IAP63
OCT 14 2005
PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:		)	PATENT APPLICATION
Inventor:	James M. Florence	)	
		)	Attorney Docket No. SLA0354
Serial No.:	10/021,988	)	
Filed:	December 13, 2001	)	
		)	Group Art Unit 2872
Title:	POLARIZED LIGHT BEAM SPLITTER ASSEMBLY INCLUDING EMBEDDED WIRE GRID POLARIZER	)	Examiner: Lavarias, A.
		)	Confirmation No.: 7651

Board of Patent Appeals and Interferences
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

BRIEF ON APPEAL

This is an appeal from the rejection by Examiner Arnel Lavarias, Group Art Unit 2872, of claims 22-40 as set forth in the CLAIMS APPENDIX, all claims in the application.

REAL PARTY IN INTEREST

The real party in interest is Sharp Laboratories of America, Inc., as assignee of the present application by an Assignment in the United States Patent Office with a Recordation Date of December 13, 2001, at Reel 012401, Frame 0464.

RELATED APPEALS AND INTERFERENCES

None.

STATUS OF THE CLAIMS

Claims 22-40 are in the application.

Claims 22-40 are rejected.

Claims 22-40 are appealed.

STATUS OF AMENDMENTS

All claim amendments made prior to the Final Office Action of August 4, 2005 have been entered. No claim amendments have been filed subsequent to the Office Action of August 4, 2005.

SUMMARY OF CLAIMED SUBJECT MATTER

The invention of claims 22 and 33 describes a polarized beam splitter assembly whose primary components are prism and a wire grid polarizer, see Fig. 1 (Evidence Appendix, Attachment B), and the specification, page 4, line 2 through page 5, line 5 (Evidence Appendix, Attachment A). The prism 12 has a first internal surface 18 and a second internal surface 20. With respect to claim 22, an adhesive 36 is formed between polarizer second surface 20 and first surface 18. The air gap

cavity 40 is formed between the prism first surface 18, prism second surface 20, and adhesive 36. The wire grid polarizer 24 is secured to internal surface 18 and extends into the air gap cavity 40. Claim 34 is similar to claim 22, but does not recite that the air gap cavity has an adhesive perimeter.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Whether the specification is objectionable under 37 CFR 1.75(d)(1) and MPEP 608.01(o), as failing to provide antecedent basis for the word "volume" as recited in claim 25.

2. Whether claims 22, 30-34, and 39-40 are unpatentable under 35 U.S.C. 103(a) with respect to Ito et al. ("Ito"; US 2003/0179345) in view of Matsuda (US 5,703,861).

3. Whether claim 23 is unpatentable under 35 U.S.C. 103(a) with respect to Ito in view of Matsuda.

4. Whether claims 24, 35, and 37 are unpatentable under 35 U.S.C. 103(a) with respect to Ito in view of Masuda.

5. Whether claim 25 is unpatentable under 35 U.S.C. 103(a) with respect to Ito in view of Matsuda.

6. Whether claims 26-27, 29, and 36 are unpatentable under 35 U.S.C. 103(a) with respect to Ito and Masuda, and further in view of Yamada et al. ("Yamada"; US 6,013,339) and Ishiwatari (JP 11007027).

7. Whether claims 28 and 38 are unpatentable under 35 U.S.C. 103(a) with respect to Ito and Matsuda, in view of Yamada and Ishiwatari.

ARGUMENT

1. The objection to the specification under 37 CFR 1.75(d)(1) and MPEP 608.01(o), as failing to provide antecedent basis for the word "volume" as recited in claim 25.

Section 6 of the Office Action objects to the specification, under 37 CFR 1.75(d)(1) and MPEP608.01(o), as failing to provide proper antecedent basis for the limitation recited in claim 25. The Office Action states that the product of the adhesive thickness and air gap cavity area does not necessarily yield the air gap cavity volume, as the thickness of the air gap varies due to the height of the wire grid elements encroaching into the air gap cavity.

The ***Response to Arguments*** Section of the Office Action states that claim 25 recites the limitation of an "air gap cavity", which inherently implies that the cavity is filled with air. The Office Action also states that the cavity is defined by the enclosed shape and cavity dimensions. The Office Action further states that the Applicant's definition of cavity volume does not apply once the cavity includes an object.

In response the Applicant submits that "air gap cavity", as recited in claim 25, does not, and is not intended to recite "the volume of air in a cavity". Alternately stated, the volume of air is not being recited. The claim specifically defines the air gap cavity volume to be the product of the maximum adhesive thickness and the air gap cavity area. It is not relevant to the definition that this volume can be filled. It is well known that an Applicant is permitted to be their own lexicographer. In claim 25, the Applicant has defined what he means by "air gap cavity".

Further, the Applicant's use of the term "volume" is entirely conventional. For example, a bottle having a 1-gallon volume is considered a 1-gallon bottle, regardless of whether it is filled with a liquid, or empty. More particularly, the air gap cavity volume does not change, regardless of whether wire grid elements encroach into the space.

2. The rejection of claims 22, 30-34, and 39-40 as unpatentable under 35 U.S.C. 103(a) with respect to Ito et al. ("Ito"; US 2003/0179345) in view of Matsuda (US 5,703,861).

In Section 8 of the Office Action claims 22, 30-34, and 39-40 have been rejected as unpatentable with respect to Ito in view of Matsuda. The Office Action states that Ito describes several elements of the claimed invention, but acknowledges that Ito fails to describe an adhesive between the polarizer and the prism, or a cavity formed by an adhesive. The Office Action also states that Matsuda describes a grid polarizer secured to a substrate via a spacer or raised projection of solder adhesive, and that it would have been obvious for one of ordinary skill to use an adhesive between a polarizer and prism such that an air gap cavity is formed by the surrounding adhesive.

An invention is unpatentable if the differences between it and the prior art would have been obvious at the time of the invention. As stated in MPEP § 2143, there are three requirements to establish a *prima facie* case of obviousness.

> First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching

> or suggestion to make the claimed combination and reasonable expectation of success must both be found in the prior art and not based on applicant's disclosure. *In re Vaeck* 947 F.2d 488, 20 USPQ2d, 1438 (Fed. Cir. 1991).

In Fig. 16 Ito describes a reflective polarizer 4 that uses a structural birefringent polarizing plate 21, which is described in the explanation of Figs. 2A and 2B [0178]. Polarizing plate 21 has a light transmissive substrate 210 in close contact with the surface of second prism 40, and a fine thin metal film structure 211 that faces first prism 10 across a small space [0179].

In Fig. 8 Matsuda describes a transparent heat sink 32 mounted to an optical coupling device 31. The heat sink surface (32a) between the heat sink and coupling device supports polarizers 34A and 34B, which include a wire grid (col. 5, ln. 35-50). Matsuda states that heat sink 32 is joined to the coupling device 31 by solder layers 47A and 47B in an outer peripheral sealing region (col. 6, ln. 1-8). Matsuda does not state that the solders layers 47A and 47B form an air cavity around polarizers 34A and 34B. Since the solders layers are shown and labeled as independent elements, the solder layers are not joined (are not a continuous layer around the perimeter). This assumption is bolstered by Matsuda's statement, "(a)s shown in Fig. 9C, the optical coupling device 31 which has been fabricated as described above, is joined to the wiring patterns 43 on the transparent substrate 32A by solder layers 47A, 47B with junction down. If necessary, the optical coupling device is *encased in a molded body of resin for protection from the ambient atmosphere* (emphasis added, see col. 7, ln. 14-21). Although Matsuda may use solder to join substrate layers, the solder does not form a cavity.

The Office Action states that it would have been obvious at the time of the invention to form an air gap cavity around the interface of polarizer and prism surfaces using an adhesive, as taught by Matsuda, in the assembly of Ito, for the purpose of providing a fixed and rigid alignment of prism blocks and wire grid polarizer, thus reducing alignment and light scattering losses in the polarized light beam splitter assembly. With respect to the first *prima facie* requirement to support a case for obviousness, the Applicant respectfully submits that there is no evidence to support a motivation to combine Matsuda's device with Ito's.

The issue of motivation does not concern itself with whether there is some element of commonality (i.e., a polarizer) between references. If it did, then any two references could be combined merely as the result of a common keyword. Although a prior art device "may be capable of being modified to run the way the apparatus is claimed, there must be a suggestion of motivation in the references to do so." *In re Mills*, 916 F.2d 680, 682, 16 USPQ2d 1430, 1432 (Fed. Cir. 1990). Here, the analysis must determine if there is any motivation to modify Ito's assembly in such a manner as to teach the claimed invention. Matsuda may possibly provide a motivation to use solder layers between substrates. However, the claimed invention is not simply the use of an adhesive. The Applicant respectfully submits that Matsuda does not suggest that Ito be modified to use solder (or any adhesive) to form a cavity. Alternately stated, even if there is a motivation to combine the Matsuda and Ito references, the invention suggested is not the claimed invention.

Considered from the perspective of the second *prima facie* requirement, even if an expert were given the Matsuda and Ito inventions

as a foundation, there is no reasonable expectation that this expert could derive the claimed invention, since the claimed invention describes a functionality (a cavity formed by a surrounding adhesive) that is not present in either of the references.

With respect to the third *prima facie* requirement, there is at least one clear distinction between the claimed invention and the cited prior art references. Although Matsuda does describe to use of a solder layer to join substrates, he does not show the formation of a cavity using a surrounding adhesive. Matsuda's cross-sectional views describe separate solder layers 47A and 47B that are not joined. Matsuda includes several plan view views of his assembly. However, none of these plan views show a cavity formed by solder layers. Matsuda neither shows nor explicitly describes the formation of a cavity surrounded and/or formed using solder layers. Since Matsuda does not describe an air gap cavity surrounded by an adhesive, and Ito does not even describe an adhesive, the combination of references does not describe the cavity limitations of claims 22 and 34. Neither does the prior art suggest any modifications that make these limitations obvious. Claims 30-33, dependent from claim 22, and claims 39-40, dependent from claim 34, enjoy the same distinctions from the cited prior art.

3. The rejection of claim 23 as unpatentable under 35 U.S.C. 103(a) with respect to Ito in view of Matsuda.

In Section 9 of the Office Action claim 23 has been rejected as unpatentable under 35 U.S.C. 103(a) with respect to Ito in view of Matsuda. The Office Action states that Matsuda describes a wire grid height that is less than the adhesive thickness.

Regardless of the wire grid height and adhesive thickness, the combination of the Matsuda and Ito references still fails to explicitly describe or suggest an air gap cavity with an adhesive perimeter, as recited in claim 22. Claim 23, dependent from claim 22, enjoys all the distinctions from the prior art detailed above in the response to the rejection of base claim 22.

4. The rejection of claims 24, 35, and 37 as unpatentable under 35 U.S.C. 103(a) with respect to Ito in view of Masuda.

In Section 10 of the Office Action claims 24, 35, and 37 have been rejected as unpatentable under 35 U.S.C. 103(a) with respect to Ito in view of Matsuda. The Office Action states that although Matsuda does not describe a uniform adhesive thickness, this feature would have been obvious to one of skill in the art.

Regardless of the uniformity of the adhesive thickness, the combination of the Matsuda and Ito references still fails to explicitly describe or suggest an air gap cavity (claim 34), or an air gap cavity with an adhesive perimeter (claim 22). Claim 24, dependent from claim 22, and claims 35 and 37, dependent from claim 34, enjoy all the distinctions from the prior art detailed above in the rejection of base claims 22 and 34.

5. The rejection of claim 25 as unpatentable under 35 U.S.C. 103(a) with respect to Ito in view of Matsuda.

In Section 11 of the Office Action claim 25 has been rejected as unpatentable under 35 U.S.C. 103(a) with respect to Ito in view of Matsuda. The Office Action states that one of ordinary skill in the art would have known how to determine the volume of the cavity.

Regardless of how the cavity volume is determined, the combination of the Matsuda and Ito references still fails to explicitly describe or suggest an air gap cavity with an adhesive perimeter, as recited in claim 22. Claim 25, dependent from claim 22, enjoys all the distinctions from the prior art detailed above in the response to rejection of claim 22.

6. The rejection of claims 26-27, 29, and 36 as unpatentable under 35 U.S.C. 103(a) with respect to Ito and Masuda, and further in view of Yamada et al. ("Yamada"; US 6,013,339) and Ishiwatari (JP 11007027).

In Section 12 of the Office Action, claims 26, 27, 29, and 36 have been rejected as unpatentable under 35 U.S.C. 103(a) with respect to Ito and Matsuda, and further in view of Yamada et al. ("Yamada"; US 6,013,339) and Ishiwatari (JP 11007027). The Office Action states that Ishiwatari and Yamada teach the use of spherical spaces to define an adhesive thickness, and that it would have been obvious to use the spacers in the beam splitter assembly of Ito, in view of Matsuda.

Even if Ishiwatari and Yamada use spherical spacers in an adhesive, the combination of the four references still fails to explicitly describe or suggest an air gap cavity, or an air gap cavity formed with an adhesive perimeter, as recited in claims 34 and 22, respectively. Claims 26, 27, and 29, dependent from claim 22, and claim 36, dependent from claim 34, enjoy all the distinctions from the prior art detailed above in the response to the rejection of claims 22 and 34.

7. The rejection of claims 28 and 38 as unpatentable under 35 U.S.C. 103(a) with respect to Ito and Matsuda, in view of Yamada and Ishiwatari.

In Section 13 of the Office Action, claims 28 and 38 have been rejected as unpatentable under 35 U.S.C. 103(a) with respect to Ito and Matsuda, and further in view of Yamada and Ishiwatari. The Office Action states that Ishiwatari and Yamada fail to specifically disclose a 30-micron adhesive thickness, but that such a thickness would have been obvious to obtain.

Even if Ishiwatari and Yamada did disclose an adhesive thickness of 30 microns, the combination of the four references still fails to explicitly describe or suggest an air gap cavity formed with an adhesive perimeter, or an air gap cavity, as recited in claims 22 and 34, respectively. Claim 28, dependent from claim 22, and claim 38, dependent from claim 34, enjoy all the distinctions from the prior art detailed above in the response to the rejection of claims 22 and 34.

SUMMARY AND CONCLUSION

It is submitted that for the reasons pointed out above, the claims in the present application clearly and patentably distinguish over the cited references. Accordingly, the Examiner should be reversed and ordered to pass the case to issue.

Authorization is provide, in the amount of $500.00, to cover the fee for this Appeal Brief. Authorization is given to charge any deficit or credit any excess to Deposit Account No. 500803.

Respectfully submitted,

Date: 10/12/05

David Ripma
Registration No. 27,672

Customer Number 27518
David Ripma, Patent Counsel
Sharp Laboratories of America, Inc.
5750 NW Pacific Rim Blvd.
Camas, WA 98607
Telephone: (360) 834-8754
Facsimile: (360) 817-8505
dripma@sharplabs.com

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ATTACHMENT F (Ishiwatari; JP 11007027)

CLAIMS APPENDIX

1-21. canceled

22. (previously presented) A polarized light beam splitter assembly comprising:

a polarized light beam splitter prism including:

a first internal surface; and

a second internal surface;

a wire grid polarizer including:

a first surface secured to the prism first surface;

a second surface raised from and parallel to the polarizer first surface, with a perimeter region and a central region;

an adhesive formed between the polarizer second surface perimeter region and the prism second surface;

an air gap cavity between the prism second surface and the polarizer second surface central region, surrounded by the adhesive; and

a wire grid attached to the polarizer second surface central region, with a height extending into the air gap cavity.

23. (previously presented) The assembly of claim 22 wherein the air gap cavity has an area defined by the polarizer second surface perimeter region and a height defined by the maximum thickness of the adhesive.

24. (previously presented) The assembly of claim 23 wherein the adhesive has a uniform maximum thickness defined between the polarizer second surface and the prism second surface; and

wherein the polarizer wire grid height is less than the adhesive maximum thickness.

25. (previously presented) The assembly of claim 24 wherein the air gap cavity has a volume defined by the product of the maximum adhesive thickness and the air gap cavity area.

26. (previously presented) The assembly of claim 25 further comprising:

spacers having a uniform size embedded in the adhesive; and

wherein the adhesive maximum thickness is defined by the spacer size.

27. (previously presented) The assembly of claim 26 wherein the spacers have a spherical shape with a diameter; and

wherein the adhesive maximum thickness is equal the spacer diameter.

28. (previously presented) The assembly of claim 26 wherein the adhesive maximum thickness is in the range of 1 and 30 microns.

29. (previously presented) The assembly of claim 26 wherein the spacers are formed on the polarizer second surface.

30. (previously presented) The assembly of claim 22 wherein the prism is a glass cube split into interfacing first and a second

sections, wherein the prism first surface is formed on the prism first section interface and the prism second surface is formed on the prism second section interface.

31. (previously presented) The assembly of claim 30 wherein the cube defines an elongated axis and wherein the prism first and second surfaces have an angle, defined with respect to the elongated axis, in the range between 1 and 89 degrees.

32. (previously presented) The assembly of claim 22 further comprising:

a light source positioned to emit light;

a reflection device; and

wherein the polarizer second surface accepts light from the light source and redirects the light toward the reflection device.

33. (previously presented) The assembly of claim 32 wherein the reflection device is device chosen from the group including a liquid crystal display panel, a mirror, and a quarter wave plate.

34. (previously presented) A polarized light beam splitter assembly, the assembly comprising:

a prism having a source axis oriented to accept light in a first polarization and an emission axis to supply light in a second polarization;

a polarizer embedded in the prism, including a glass substrate with parallel first and second surfaces, and a wire grid formed overlying the glass substrate first surface; and

an air gap cavity interposed between the glass substrate first surface and the prism.

35. (previously presented) The assembly of claim 34 wherein the prism has a first interior surface and a second interior surface;

wherein the glass substrate first surface has a perimeter; and

the assembly further comprising:

an adhesive having a uniform maximum thickness interposed between the glass substrate first surface perimeter and the prism first interior surface; and

wherein the air gap cavity is formed by prism first interior surface, the glass substrate first surface, and the adhesive.

36. (previously presented) The assembly of claim 35 further comprising:

uniformly sized spacers embedded in the adhesive.

37. (currently amended) The assembly of claim 35 wherein the wire grid has a height; and

wherein the adhesive maximum thickness is greater than the wire grid height.

38. (previously presented) The assembly of claim 35 wherein the adhesive maximum thickness is in the range of 1 and 30 microns.

39. (previously presented) The assembly of claim 34 further comprising:

a light source to supply the light;

a reflection device; and

wherein the wire grid accepts light from the light source and redirects the light toward the reflection device.

40. (previously presented) The assembly of claim 39 wherein the reflection device is device chosen from the group including a liquid crystal display panel, a mirror, and a quarter wave plate.

EVIDENCE APPENDIX

ATTACHMENT A

POLARIZED LIGHT BEAM SPLITTER ASSEMBLY INCLUDING EMBEDDED WIRE GRID POLARIZER

Inventor: James M. Florence

Field Of The Invention

This invention relates to a polarized light beam splitter assembly including an embedded wire grid polarizer and, more particularly, to an assembly wherein spacers are used to ensure a uniform distance between the embedded wire grid polarizer and an internal surface of the polarized light beam splitter so as to ensure a uniform air gap between the wire grid and the internal surface.

Background Of The Invention

Wire grid polarizers are made by fabricating a very fine grid pattern of metal stripes on an outer surface of a thin substrate, typically glass. The fabrication techniques generally use lithographic exposures that are best completed on wafers that can be easily handled by semiconductor fabrication equipment.

When used as a polarized light beam splitter (PBS) control element, the wire grid plate is tilted at a forty five degree angle with respect to a light source to reflect S-polarized light, for example, onto a mirror and a 1/4 waveplate, or onto a reflective liquid crystal display (LCD) device. The desired output is modulated to P-polarization and then reflects through the tilted wire grid polarizer. This tilted plate configuration introduces two problems. First, the tilted glass substrate will introduce astigmatism into the projected image. This will cause horizontal and vertical features of the desired projected image to come to focus in separate image planes. The second problem is that the tilted

plate occupies a certain space and the projection optics must have sufficient back working distance to operate over the length of that space. This can be a problem if the desired focal length of the projection lens is small.

Most PBS structures use a cubic prism configuration that imbeds the polarizing surface inside a cube of glass. This cubic configuration presents flat sides perpendicular to the optical axis of the projection system which introduces no astigmatism into the projected image. Additionally, because the cube is made of glass having an index of refraction greater than air, the effective back working distance of the projection optics will be reduced.

Wire grid polarizing structures are best manufactured on flat, thin substrates. Currently, there is no convenient method of producing the grids directly on a prism face. Additionally, operation of the wire grid requires air on the metal side of the grid, which prevents the wire grid from being glued or abutted directly against a glass prism face. Due to these manufacturing and operational limitations, there appears to be no prior art solution to fabricate a viable PBS prism using an embedded wire grid polarizer.

Summary Of The Invention

The assembly of the present invention utilizes spacers to ensure a uniform distance between the exposed surface of an internal wire grid polarizer and a corresponding internal surface of the polarized light beam splitter prism so as to ensure a uniform air gap between the two surfaces within the prism. The spacers typically comprise rigid spheres having a precise predetermined outer diameter. The spacers are generally contained within an adhesive, such as epoxy, which is used to adhere the

exposed surface of the wire grid polarizer to the internal surface of the prism, around the outer edge of the two surfaces. The exposed surface of the wire grid polarizer and the internal surface of the prism are forced together during adhesion so that the two surfaces are uniformly separated by the width of a single spacer.

Accordingly, an object of the invention is to provide a beam splitter assembly having an embedded wire grid polarizer.

Another object of the invention is to provide a beam splitter assembly having an internal air gap positioned between an exposed surface of a wire grid polarizer and an internal surface of a PBS prism.

A further object of the invention is to provide a beam splitter assembly having a uniform spacing between an internal surface of the assembly and an exposed surface of an internal wire grid polarizer.

Still a further object of the invention is to provide a method of manufacturing a beam splitter assembly having an embedded wire grid polarizer.

These and other objects and advantages of the invention will become more fully apparent as the description that follows is read in conjunction with the drawings.

Brief Description Of The Drawings

FIG. 1 is a schematic of the polarized light beam splitter assembly including an embedded wire grid polarizer.

FIG. 2 is a cross sectional view of the polarized light beam splitter assembly taken along line 2-2 of FIG. 1.

FIG. 3 is a detailed view of the edge region of the assembly of FIG. 1.

Detailed Description Of The Preferred Embodiments

Turning now to the drawings, FIG. 1 shows a schematic of the polarized light beam splitter (PBS) assembly 10 including an embedded wire grid polarizer. In particular, assembly 10 includes a polarized light beam splitter prism 12 including first and second halves 14 and 16, respectively. Prism 12 typically comprises a glass cube but other shapes and materials may be utilized as is known in the art. In the preferred embodiment, halves 14 and 16 of prism 12 typically each comprise a triangular section, each section having an internal surface 18 and 20, respectively, wherein surfaces 18 and 20 are positioned at a forty five degree angle to an axis 22 of light emission from the prism.

An internal wire grid polarizer 24 is secured to one of internal surfaces 18 or 20. In the embodiment shown, polarizer 24 is adhered to internal surface 18 of prism section 14. In other embodiments, the wire grid polarizer may be adhered to a surface at an angle other than forty five degrees from the light emission axis, or at a position other than at the diagonal center of the polarized light beam splitter. In the preferred embodiment, wire grid polarizer 24 comprises a thin glass substrate 26 with a wire grid 28 positioned on an external surface 30 of substrate 26. Substrate 26 may be adhered completely across its inner surface 32 to internal surface 18 of prism 12 by adhesive material 34, such as epoxy or glue, or any other means suitable for the particular application. Substrate 26 typically is adhered to surface 18 completely across surface 32 so as to reduce irregularities or spatial differences in the type or the thickness of the securement mechanism positioned within the light path through the prism.

Still referring to FIG. 1, substrate 26 is adhered to second section 16 of prism 12 by adhesive 36, such as epoxy, including spacers 38 distributed therein. Spacers 38 position surface 30 of wire grid polarizer 24 a uniform distance from surface 20 of prism section 16 to create an air gap 40 therebetween. This spacing is more clearly shown in detail region 3, shown in FIG. 3.

Still referring to FIG. 1, assembly 10 comprises a light source 42 which provides, for example, S-polarized light 44. The light source may provide, however, any type or orientation of light as is desirable for a particular application. The S-polarized light 44 is reflected by wire grid polarizer 24 of prism 12 so that the S-polarized light is re-directed toward a reflection device 46, such as a mirror and a 1/4 wave plate, or a liquid crystal display device, positioned adjacent prism 12. Of course, other reflection devices as known in the art may also be utilized. Reflection device 46 modulates the S-oriented light to P-oriented light 48 which is reflected back through the embedded tilted wire grid polarizer 24 and along light emission axis 22. As light passes through air gap 40, the small tilted air gap, i.e., tilted with respect to axis 22, introduces some astigmatism to the produced image. However, the astigmatism introduced into the produced image due to air gap 40 is quite small relative to the astigmatism introduced into the produced image by the tilted glass substrate.

FIG. 2 is a cross sectional view of the assembly taken along line 2-2 of FIG. 1. Adhesive 36 is shown positioned around an edge region 50 of substrate 26 so that adhesive 36 does not interfere with light passing through a central region 52 of prism 12. Spacers 38 are shown randomly distributed throughout adhesive 36 in edge region 50.

FIG. 3 shows a detailed view of the edge region of the internal wire grid polarizer secured within prism 12. Spacers 38 typically are rigid spheres each having a uniform outer diameter 54, wherein the length of diameter 54 is chosen to correspond to a desired width 56 of air gap 40. The spacers typically are distributed within adhesive 36, such as an epoxy. The adhesive is thereafter placed between external surface 30 of wire grid polarizer 24 and internal surface 20 of second prism section 16, around the perimeter 50 of the two surfaces. The perimeter of surface 30 of wire grid polarizer 24 typically does not include any wires (shown in end view in this figure) of wire grid 28. The two prism sections are then forced together so that surfaces 20 and 30 are spaced uniformly from one another by a distance 56, i.e., the diameter of the spacers. In other words, the epoxy will be squeezed from between the spacers and surfaces 20 and 30 so that the spacers will directly contact both surfaces 20 and 30 within the prism. Accordingly, the spherical spacers will hold the two prism sections separated by a predetermined uniform distance. In other embodiments, other shaped spacers may be utilized such as raised rectangular spacers manufactured directly on the perimeter of the glass substrate. In such an embodiment, adhesive would be placed between or around the rectangular spacers to as to secure the two prism sections together.

In the preferred embodiment the internal surfaces of the prism, and the two surfaces of the wire grid substrate are each parallel to one another, and each define an angle 58 of approximately forty five degrees with respect to axis 22 of the assembly. Of course the internal surfaces of the prism may be manufactured at other angles as dictated by each particular application, such as angles in a range of one to eighty nine degrees.

In one embodiment each of spacers 38 may have a diameter 54 of approximately 10 μm. In other embodiments the spacers may have a smaller or a larger diameter, such as a diameter in a range of 1 to 30 μm, so as to provide a corresponding width air gap 40. However, if spacers having too small a diameter are used, the resulting air gap will be too thin and will cause reduced PBS performance by evanescent coupling of the light waves from one prism block section to another. The diameter of the spacers used, therefore, should be chosen according to the particular dimensions and qualities of the prism and light being used. In each particular embodiment, each of the spacers distributed within epoxy 36 typically will have the same diameter or height 54 as the other spacers. This will ensure a uniform air gap between the two prism sections. However, smaller sized spacers may be used within an epoxy containing larger sized spacers, wherein the large sized spacers will define the width of the air gap.

Thus, a polarized light beam splitter having an internal wire grid polarizer, and a method of manufacturing the same, has been disclosed. Although preferred structures and methods of manufacturing the device have been disclosed, it should be appreciated that further variations and modifications may be made thereto without departing from the scope of the invention as defined in the appended claims.

ATTACHMENT B

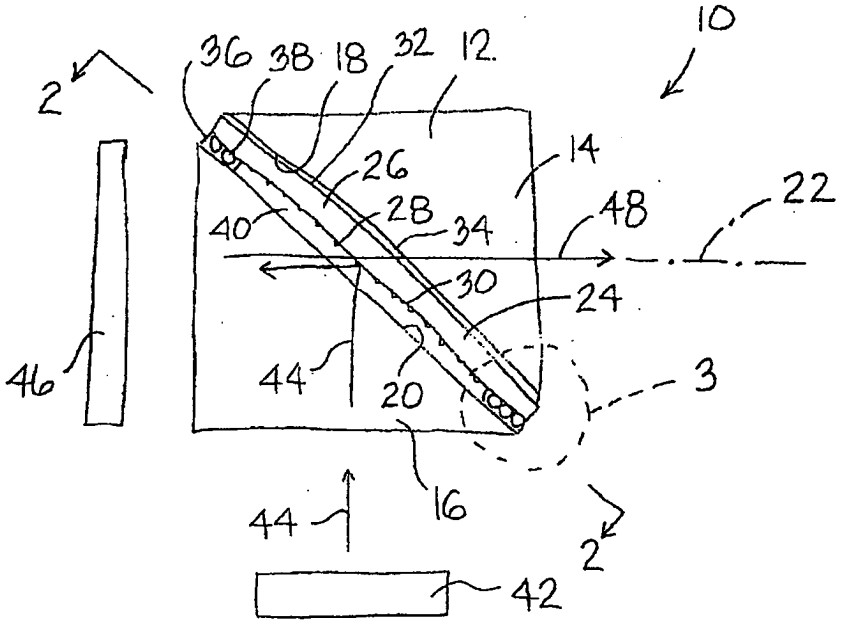

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FIG. 1

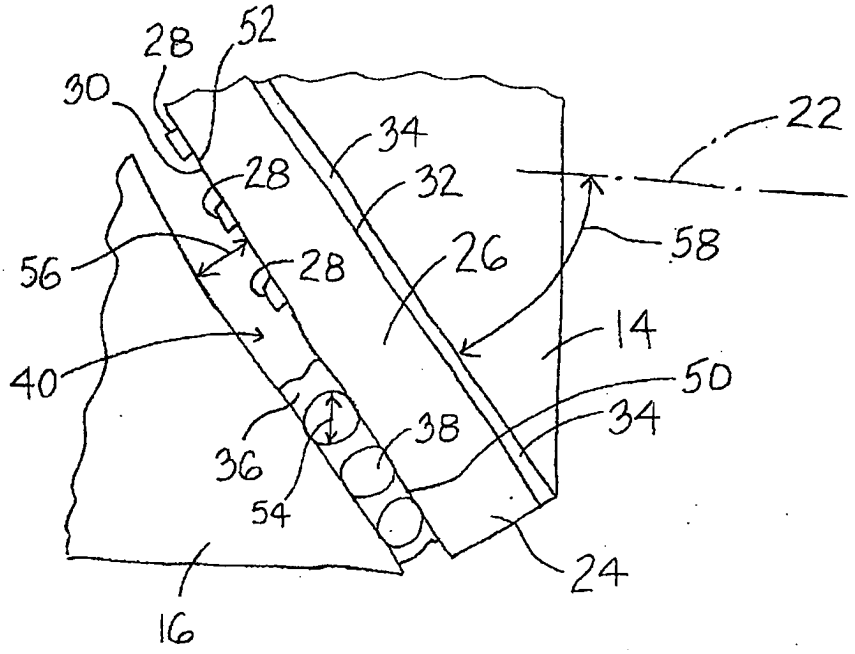

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FIG. 3

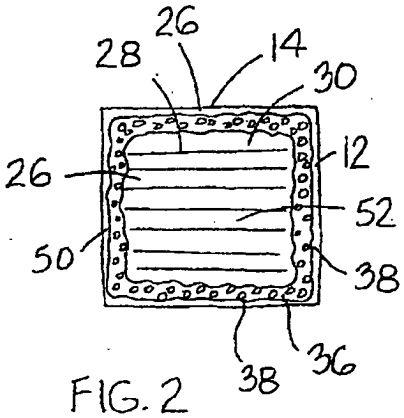


FIG. 2

ATTACHMENT F

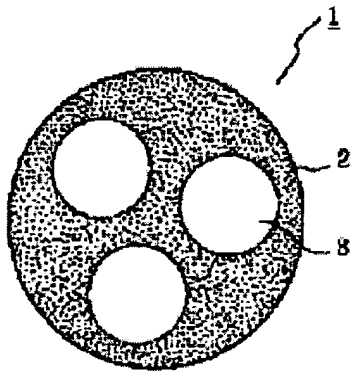
ADHESIVE SPACER, LIQUID CRYSTAL ELEMENT USING THE SAME AND ITS PRODUCTION

Patent number: JP11007027
Publication date: 1999-01-12
Inventor: ISHIWATARI KAZUYA
Applicant: CANON KK
Classification:
- international: G02F1/1339; G02F1/1341
- european:
Application number: JP19970158184 19970616
Priority number(s): JP19970158184 19970616

Report a data error here

Abstract of **JP11007027**

PROBLEM TO BE SOLVED: To make it possible to well control and maintain a cell gap without increasing the number of stages of work and/or the number of particles by including plural spacer beads into adhesive particles. SOLUTION: The adhesive spacers 1 include the plural spacer beads 3 within the particles consisting of adhesives 2. Then, a sufficient amt. of the adhesives 2 may be retained within one particle by holding the adhesives 2 between the spacer beads 3, by which an adhesive area is widened and adhesive powder is improved. Even if the spacer beads 3 of the same number are used, plural pieces of the spacer beads solidify at one point and, therefore, the number of the particles decreases drastically and the influence on liquid crystal orientation decreases. These adhesive spacers are produced by adding the spacer beads 3 into the epoxy adhesives, etc., and agitating the spacer beads until the distribution is made uniform, then forming the particles by using a mill and obtaining a desired size by a centrifugal sepn. method, etc. At this time, the adhesive spacers are so formed that plural pieces of the spacer beads 3 may enter the inside of the adhesive particles.



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DERWENT-ACC-NO: 1999-137826

DERWENT-WEEK: 199912

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TITLE: Spacer for maintaining cell gap in liquid crystal elements for colour TV, PC, pachinko game machine - uses spacer beads embedded in epoxy adhesive agent to maintain cell gap between two substrates of liquid crystal element

PATENT-ASSIGNEE: CANON KK[CANO]

PRIORITY-DATA: 1997JP-0158184 (June 16, 1997)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
JP 11007027 A	January 12, 1999	N/A	004	G02F 001/1339

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
JP 11007027A	N/A	1997JP-0158184	June 16, 1997

INT-CL (IPC): G02F001/1339, G02F001/1341

ABSTRACTED-PUB-NO: JP 11007027A

BASIC-ABSTRACT:

NOVELTY - Several spacer beads (3) are embedded in an epoxy adhesive (2) to form bonding spacer. The bonding spacer maintains constant cell gap between
two substrates of the liquid crystal element. The cell gap is equal to the bead diameter.

USE - For liquid crystal elements of colour TV,PC, pachinko game machine.

ADVANTAGE - Cell gaps are produced using less number of processes. Liquid crystal orientation is not affected as only few spacer beads need to be used. Improves display quality. DESCRIPTION OF DRAWING(S) - The figure shows a cross
sectional model diagram of liquid crystal element using the bonding spacer. (2) Adhesive agent; (3) Spacer beads.

CHOSEN-DRAWING: Dwg.1/2

TITLE-TERMS: SPACE MAINTAIN CELL GAP LIQUID CRYSTAL ELEMENT COLOUR TELEVISION
GAME MACHINE SPACE BEAD EMBED EPOXY ADHESIVE AGENT MAINTAIN CELL
GAP TWO SUBSTRATE LIQUID CRYSTAL ELEMENT

DERWENT-CLASS: A85 L03 P81 U14

CPI-CODES: A05-A01E; A12-L03B; L03-G05B;

EPI-CODES: U14-K01A1D;

SECONDARY-ACC-NO:
CPI Secondary Accession Numbers: C1999-040764
Non-CPI Secondary Accession Numbers: N1999-100829

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特開平11－7027

(43)公開日　平成11年(1999)１月12日

(51)Int.Cl.[6]		識別記号	FI		
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	1/1341			1/1341	

審査請求　未請求　請求項の数４　ＯＬ　（全４頁）

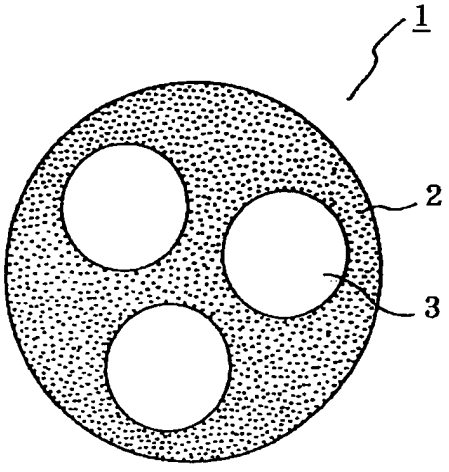
(21)出願番号　特願平9－158184

(22)出願日　平成９年(1997)６月16日

(71)出願人　000001007
キヤノン株式会社
東京都大田区下丸子３丁目30番２号
(72)発明者　石渡　和也
東京都大田区下丸子３丁目30番２号　キヤノン株式会社内
(74)代理人　弁理士　渡辺　敬介　（外１名）

(54)【発明の名称】　接着スペーサー、これを用いた液晶素子とその製造方法

(57)【要約】
【課題】　一対の基板間に液晶を挟持してなる液晶素子において、液晶配向に影響を与えることなく、また、工程数を増やすことなくセルギャップを形成し、液晶注入後も該セルギャップを維持する。
【解決手段】　エポキシ系の接着剤２からなる接着剤粒子中に複数のスペーサービーズ３を内包させてなる接着スペーサー１を一方の基板上に散布し、他方の基板を載せて加圧し、該接着スペーサー１を押しつぶして両基板を接着することにより、スペーサービーズ３の径と略同等のセルギャップを形成する。



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【特許請求の範囲】

【請求項1】　接着剤粒子中に複数のスペーサービーズを内包してなることを特徴とする接着スペーサー。

【請求項2】　上記接着剤がエポキシ系接着剤である請求項1記載の接着スペーサー。

【請求項3】　一対の基板間に液晶を挟持してなる液晶素子の製造方法であって、一方の基板上に請求項1又は2に記載の接着スペーサーを散布し、他方の基板を対向配置して加圧し、該接着スペーサー内のスペーサービーズの径と略同じ大きさのセルギャップを介して両基板を貼り合わせることを特徴とする液晶素子の製造方法。

【請求項4】　請求項3記載の製造方法によって製造されたことを特徴とする液晶素子。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、カラーテレビ、パーソナルコンピュータ、パチンコ遊戯台等に使用される液晶素子、及び該素子のセルギャップを制御するためのスペーサーに関する。

【0002】

【従来の技術】一対の電極を有する基板間に液晶を挟持してなる液晶素子において、2枚の基板間のセルギャップ（液晶層の厚み）は、一般にセルギャップ出し工程において、基板表面（通常、配向膜表面）に散布された硬質プラスチック材又はSiO_2材を主成分とするスペーサーにより制御される。

【0003】しかしながら、真空注入方式による液晶のセルへの注入工程において、液晶注入時にセルの内圧が高くなり、該セルが膨らむ。この時、スペーサーは両側の基板表面に同時に接することができない。そのため、大型の液晶素子の場合、表示領域においてセルギャップにバラツキを生じ、表示品位を損なう場合がある。

【0004】そのため、一般にスペーサーの表面に0．1～0．3μmの厚さに熱可塑性プラスチックやエポキシ系接着剤を塗布し、2枚の基板を表示領域内で接着するか、または、量産技術的には、液晶注入後、封口前に両基板の外側から加圧処理して再セルギャップ出しを行なっている。

【0005】中でも、強誘電性液晶を用いた液晶素子においては、単に表示品位のみではなく衝撃による液晶の配向状態の乱れを防ぐ必要性から、特開昭62－174284号公報に記載されているように、スペーサーとは別に、基板表面に散布したエポキシ系接着剤粒子により上下基板を接着固定して、スペーサーにより一度形成されたセルギャップを連続して維持する手段がとられる場合もある。

【0006】

【発明が解決しようとする課題】しかしながら、上記したスペーサー表面に熱可塑性プラスチックや接着剤等樹脂を塗布する方法においては、スペーサー材料と塗布する樹脂材料との相互の性質や塗布する際の樹脂の物性などから、塗布し得る膜厚に限度があり、樹脂の接着力と併せて、ギャップ出し工程において表示領域全体に形成したギャップを液晶注入後まで維持するのは困難であった。

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【0007】実際の商品では、熱可塑性樹脂をスペーサーに塗布しているが、該樹脂は主にスペーサーを一方の基板に固定するために使用されており、ギャップ制御までは考慮されていない。

【0008】また、前記した強誘電性液晶素子におけるスペーサーと接着剤粒子の併用では、スペーサー散布工程に加えて接着剤粒子の散布工程が必要であり、工程数が増えるという問題があり、また、スペーサーと接着剤粒子を併用することで単位面積当たりに散布される粒子数が増え、液晶の配向に悪影響を及ぼす場合がある。

【0009】本発明の目的は、工程数や粒子数を増加させることなく、良好にセルギャップを制御し、維持し得るスペーサーを提供し、液晶の配向に悪影響がなく、良好な表示の液晶素子を構成することにある。

【0010】

【課題を解決するための手段】本発明の第一は、接着剤粒子中に複数のスペーサービーズを内包してなることを特徴とする接着スペーサーであり、第二は、一対の基板間に液晶を挟持してなる液晶素子の製造方法であって、一方の基板上に本発明第一の接着スペーサーを散布し、他方の基板を対向配置して加圧し、該接着スペーサー内のスペーサービーズの径と略同じ大きさのセルギャップを介して両基板を貼り合わせることを特徴とする液晶素子の製造方法であり、さらに第三は、該製造方法によって製造されたことを特徴とする液晶素子である。

【0011】

【発明の実施の形態】図1に本発明の接着スペーサーの一実施形態の断面図を、図2に該接着スペーサーを用いた本発明の液晶素子の一実施形態の断面図を模式的に示す。図中、1は接着スペーサー、2は接着剤、3はスペーサービーズ、11a，11bは透明基板、12はカラーフィルタ、13は平坦化層、14a，14bは透明電極、15a，15bは配向膜、16は液晶である。本実施形態には、カラー表示用の液晶素子の一構成例を示したが、本発明は、一対の基板間に液晶を挟持してなる液晶素子であれば従来の液晶素子全てに好ましく適用することができる。

【0012】図1に示される様に、本発明の接着スペーサー1は、接着剤2からなる粒子内に複数のスペーサービーズ3を内包している。従って、スペーサービーズ間に接着剤を保持することで充分な量の接着剤を1粒子内に持つことができるため1個のスペーサービーズの周囲に接着剤層を形成した場合に比べて、接着面積が広くなり、接着力が大幅に向上する。しかも同じ数のスペーサービーズを用いても、一箇所に複数個のスペーサービー

ズが固まるために、粒子数としては大幅に低減されるため、液晶配向への影響も低減する。

【0013】本発明の接着スペーサーの製造方法について説明する。

【0014】先ず、接着剤中にスペーサービーズを添加し、分布が均一になるように撹拌する。本発明において接着剤としてはエポキシ系接着剤が好ましく用いられる。その理由は、熱硬化のみで接着し得るため、工程が簡易になるためである。接着剤としてはこの他に光硬化型の樹脂等を用いることができる。上記撹拌の後、ミルを用いて粒子を形成し、遠心分離方法もしくは沈降方法を用いて所望のサイズを得る。この時に、接着剤粒子中にスペーサービーズが複数個入る様にする。1個の接着剤粒子中に入るスペーサービーズの個数は特に限定されないが、2～5個程度内包されるように形成するのが好ましい。

【0015】本発明においては、所定の部材を作り込んだ一方の基板上に、上記接着スペーサーを散布する。その個数は液晶の配向への影響を考慮すると60～150個／mm^2 が好ましい。他方の基板にはシール材を描画しておき、これらを重ね合わせて貼り合わせる。その際、20～80g／cm^2 程度の圧力をかけ、基板間に散布した接着スペーサーを押しつぶして内包されるスペーサービーズによってセルギャップを形成すると同時に、上下基板を接着する。

【0016】

【実施例】

［実施例1］一方にカラーフィルタや遮光層を形成した一対のガラス基板上に、液晶を駆動するための透明電極及びショート防止用絶縁層、さらには配向膜を形成し、所望のプレチルトを得られるように配向処理を施した。一方の基板上に直径が6μmの接着スペーサーを90個／mm^2 になるように散布した。該接着スペーサーの接着剤はエポキシ系接着剤で内包されるスペーサービーズは直径1．0μmのSiO_2ビーズであり、スペーサービーズの正規分布の中心値は3個であった。

【0017】他方の基板にはシール材を描画し、上記スペーサービーズを散布した基板に載せて装置にて圧着し、仮止めをしてシール硬化炉に入れてセルを形成した。該セルに真空注入方法にて液晶を注入し、注入口を封口して液晶素子とした。このようにして作成された液晶素子は、液晶注入時に接着スペーサーが基板から剥れることもなく、均一なセルギャップを実現できた。

【0018】［実施例2］接着スペーサーの径を3μmとし、内包されるスペーサービーズの正規分布の中心値が2個となるようにして120個／mm^2 の密度で散布した以外は実施例1と同様に液晶素子を形成した。

【0019】このように小さい径の接着スペーサーは、例えばドットサイズが数10μmと小さいパネルの場合等において液晶配向への影響を抑える上で有効である。ただし、このサイズの接着スペーサーを得るためにはミルでの粒子造粒に時間がかかると同時に、分粒の際の歩留が悪くなるためにコストがかかる。

【0020】本実施例の液晶素子においては均一なセルギャップ及び上下基板の固定維持能力が得られ、表示品位の良い液晶素子であった。

【0021】尚、基板の接着力の点では実施例1の液晶素子に劣るため、本実施例の如く小粒径の接着スペーサーを用いる場合には、セルへの液晶注入時の真空引き・排気条件を穏やかにすることが望ましい。

【0022】

【発明の効果】以上説明したように、本発明の接着スペーサーを用いて液晶素子を製造すると、工程数を増やすことなく、良好にセルギャップ出しを行なうと同時に上下基板を強固に接着することができるため、液晶注入等によってセルギャップが変動することなく維持して良好な表示を行なうことができる。また、接着剤粒子とスペーサーを併用した場合に比べて粒子数を大幅に削減できるため、粒子の存在による液晶配向への悪影響も抑制され、表示品質も向上する。

【図面の簡単な説明】

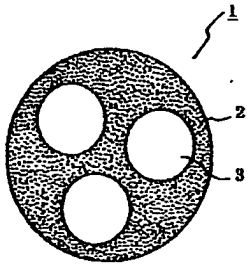
【図1】本発明の接着スペーサーの一実施形態の断面模式図である。

【図2】本発明の液晶素子の一実施形態の断面模式図である。

【符号の説明】

1　接着スペーサー
2　エポキシ系接着剤
3　スペーサービーズ
11a，11b　透明基板
12　カラーフィルタ
13　平坦化層
14a，14b　透明電極
15a，15b　配向膜
16　液晶

【図1】



【図2】

